

SEMICONDUCTOR MANUFACTURER GOES SOLAR

As increasing demand for electricity clogs the world's power lines, like traffic jams on our freeways, solar generation electric systems strategically built on homes and buildings can provide much needed electricity without burdening our already stressed and aging electrical routes. And, with the rapid increase in natural gas and fossil fuel prices, solar electricity is rapidly becoming one of the most competitive electric generation options on the market given government rebate programs.

Since PV systems were first commercially sold back in the late 1950's, global PV prices have dropped exponentially, while production rates have steadily increased. According to the National Renewable Energy Laboratory (NREL), the cost of electricity from photovoltaic panels has dropped from several dollars per kilowatt-hour (kWh), to around 20 to 25-cents a kWh today.

As a result of this drop in price, global photovoltaic production has increased 35 percent every year for the last five years. In addition, states across the country have adopted public policies to lower the initial capital cost of purchasing customer-owned solar electric generating systems, as well as policies to ensure fair, open access to the

distribution grid. California -- boasting some of the best incentives in the United States -- is one of the most important solar markets in the world, second only to Japan and Germany.

Among the many large corporations with that are investing in PV as a way to guarantee reliable and uninterrupted power, is Cypress Semiconductor. Located in the heart of California's Silicon Valley, Cypress Semiconductor is a global supplier of high-performance integrated circuits. Their semiconductor products support network communications applications for a wide range of industry standards. Like many California companies that fell victim to the energy crisis that gripped the state in recent years, Cypress sought ways to offset expensive peak power purchases from the utility grid. After evaluating multiple renewable energy alternatives, Cypress Semiconductor decided to incorporate solar PV technology to reduce their operating costs and take a leadership role in promoting renewable technology.

"Obviously, with power costs increasing approximately 25 percent or more every six months in California a year and a half ago, Cypress needed an alternate approach to offset our grid power costs. Solar was becoming a viable economical solution, in addition to the ecological benefits, so the decision of implementing a solar distributed generation solution was easy to make," said David Smith, Director of Corporate Facilities.

When asked why Cypress Semiconductor chose solar, Smith replied, "It just made sense. Although from an economic standpoint it probably was not the cheapest solution, solar was the quickest and easiest to permit, and was a convenient solution that did not use up any of our surface area on the San Jose campus. It is a non-polluting, clean source of power. Overall, it just seemed to be the best fit for us when compared to the other DG alternatives that were out there," he explained.

Cypress chose a commercial-scale solar electric generating system that was designed, manufactured and installed by Berkeley-based PowerLight Corporation. Last July, PowerLight completed the installation of a 335 kW solar electric generation system at Cypress' headquarters in San Jose, California. The PowerLight system covers Buildings 2 and 6 on the San

Jose campus, and is currently the largest solar rooftop installation in the Silicon Valley -- spanning 32,750 square feet of combined roof area.

"Silicon Valley is a natural leader in recognizing and implementing new solutions to California's energy needs," said PowerLight Chief Executive Officer Tom Dinwoodie. "As with the introduction of distributed computing, onsite distributed solar generation offers customers flexibility and increased control over their energy demand. Cypress' new 335 kW solar system will help Cypress efficiently and reliably meet its energy needs, and provide excess generation back to the grid for a return."

The photovoltaic systems installed at the Cypress campus are a lightweight building-integrated photovoltaic roofing assembly that is installed over an existing roof membrane. The photovoltaic system utilizes silicon technology to convert sunlight directly into electricity. The direct current (DC) output from the PV modules is converted to alternating current (AC) electricity by inverters located at each building and then stepped up to 480 volt, three-phase AC electricity by isolation transformers for connection to the buildings' service panels.

Building 6's array is made up of 888 PowerGuard tiles. PowerGuard is a patented, lightweight PV roofing assembly that delivers solar electricity to the building while protecting the roof from damaging effects of weather and UV radiation. Building 2's array is made up of 1,160 tiles which use a new type of solar module that combines two photovoltaic generation technologies in one solar cell to create greater efficiencies. The solar roof panels also reduce heating and air conditioning costs due to their insulation and thermal reflection value, as well as protect the roof for 30 years from thermal cycling and UV degradation. In addition, the modular design of PowerGuard technology enabled the system to be tailored exactly to Cypress' buildings' specific application requirements.

According to Smith, using PowerLight's solar electric modular rooftop system, the onsite electricity generated by an unused asset -- the roof space -- became a

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MICHIGAN FOCUSES ON FUEL CELLS

Thanks to a revitalization plan designed to nurture innovation, strengthen collaboration and spur long term growth and job creation in the alternative energy industry, Michigan could soon become the world's leader in fuel cell research, development, manufacturing and commercialization.

Last April, then Michigan Governor John Engler unveiled NextEnergy -- a comprehensive economic development plan to transform Michigan into a high-tech leader in alternative energy technology, attract millions of dollars in investments and create several hundred jobs. Engler championed the \$52 million, three-year initiative, along with Doug Rothwell, then chief executive of the Michigan Economic Development Corp. (MEDC).

Included in the detailed blueprint is the vision for a technology center and a business incubator for the research and development of fuel cells and other energy systems. Fuel cells are considered by many to be the "holy grail" of energy production because they use a chemical reaction between hydrogen and oxygen to produce electricity with virtually no emissions other than water and heat. In fact, the technology is viewed by numerous industry experts and environmentalists as a possible alternative to fossil fuels.

In addition to environmental concerns and the risk of continued dependence on foreign oil, NextEnergy was created in response to recent technological developments that suggest the days of the internal combustion engine, which has been the dominant driving force of the automotive industry for the past century, may be numbered. The market for fuel cell products is expected to grow to an estimated \$95 billion by 2010 and many of the world's leading automakers, including the "Big Three" -- General Motors, Ford and Daimler-Chrysler -- have already pumped billions of dollars into fuel cell research and development. Although there are significant hurdles yet to be overcome in the development of a cost-effective automotive fuel cell and a viable infrastructure, the impli-

cations for the automotive industry and the State of Michigan could be truly profound.

Michigan has historically been home to a substantial amount of engine and transmission manufacturing facilities. The advent of a new power system replacing the internal combustion engine puts Michigan at risk of losing as many as 200,000 jobs that are tied to the engineering and manufacturing of engines and transmissions. This loss would result in a \$10 billion hit to the state's economy.

"Michigan cannot sit back and assume that being home to the auto industry today guarantees we will remain home to this critical industry tomorrow. Our opportunity is to build on Michigan's strength. Our cluster of auto innovation must become a cluster of energy innovation," Governor Engler said.

Founded as a non-profit corporation in October 2002, NextEnergy is aimed at addressing these problems and bringing fuel cells, for both vehicles and stationary applications, into practical use. The program will also encourage the production of other alternative energy sources, such as wind and solar technologies.

Originally the "brain child" of Engler, NextEnergy was warmly embraced and continues to be strongly supported by current Governor, Jennifer Granholm. A centerpiece of Governor Granholm's high-tech vision for Michigan's future is the NextEnergy Center. NextEnergy dedicated the site for its new facility in December of 2002 at the Wayne State University Research and Technology Park, which has been designated an Alternative Energy Renaissance Zone by the City of Detroit.

Created in 1996 by MEDC, the Renaissance Zone program sets aside geographic areas of the state as virtually tax-free for any business or resident located in or moving to one of the zones. The NextEnergy zone offers up to 20-year state and local tax exemptions for companies that locate and perform alternative energy research, development, manufacturing, and education related to alternative energy

technology. The NextEnergy initiative also includes statewide tax incentives for companies involved in new alternative energy research, development and manufacturing expanding or locating anywhere in Michigan.

"The facility will help foster a new era for carmakers and the Motor City and was proposed as a way for Michigan to become the global hub for alternative energy development," said NextEnergy Chief Operating Officer, Steve Arwood. "The goal of the center is to take everything that everybody is working on in alternative energy policy, technology, and economic development and put it all in one spot."

The new, 40,000 sq. ft facility will serve as a comprehensive clearinghouse and information resource on alternative energy technologies and will house laboratories, education facilities, product demonstration areas, office space and interactive space for understanding of alternative energy. Currently in the final design stages, crews are expected to begin construction of the facility this September and construction is expected to be finished 12 to 18 months after the crews begin.

"The Center will be built using the latest in design and function of alternative energy systems and will serve as a working laboratory of energy efficiency and environmental friendliness, while pushing the demonstration of alternative energy to a higher level," said Arwood.

Incorporating the latest technology in the building's electrical, and heating and cooling systems, the facility's power grid will include the use of fuel cells, advanced internal combustion engines, sterling engines, as well as photovoltaics and advanced solar systems. NextEnergy could also grow to incorporate a hydrogen filling station, which as Arwood sees it, could set the stage for hydrogen-powered mass transit sometime in the future.

Arwood also emphasized the importance of educating tomorrow's alternative energy leaders. "Education is one of the cornerstones of the NextEnergy strategic

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SEMICONDUCTOR MANUFACTURER, CONTINUED FROM PAGE 1

significant component in reducing operating costs, generating clean, reliable electricity, and reducing building energy load and peak demand costs. "The installation has been beneficial in many ways. It has helped make us a green company and has assisted us in offsetting the peak demand and power requirements for the state by eliminating 335 kW worth of generating capacity that would have to come from another source. Overall I think it is a win-win deal," he said.

More specifically, Smith says the installation has saved the company \$40,000 year-to-date in power costs, with a projected return on investment of seven to eight years. Smith also says the system has been

working extremely well, with the exception of a single minor glitch.

"We have had only one very minor problem with one of the panels that short-circuited, but it was quickly replaced and we haven't had a problem since. We have had the panels up, online and running at 100 percent potential for about a year now and things are running very well," he said. "We are going to continue our DG strategy with solar. Our current plan is to install about 1 megawatt worth of generation capacity onsite within the next three to five years. We are about one-third of the way there."

Cypress president and CEO T.J. Rodgers says he is confident that the sys-

tem will satisfy the needs and future goals of the company and sees no reason why other Silicon Valley firms shouldn't follow suit.

"Investing in clean, reliable solar energy is consistent with Cypress's track record of being pioneers in technology innovation and leaders in our community. Commercially-sized solar PV is a smart long-term investment, especially during tough economic times," said Rodgers. "On-site solar PV addresses our nation's energy security and insulates us from future price volatility. Wider PV deployment will ensure all Americans a safe, reliable and stable energy supply, while reducing our dependence on foreign energy sources."

MICHIGAN FUEL CELLS, CONTINUED FROM PAGE 2

plan. The company is concentrating on getting community colleges and four-year universities to increase technology-related curriculum to ensure that Michigan has the skilled workforce for this new industry," he said.

On May 28, 2003, NextEnergy announced Education Grant Awards totaling \$750,000 to three Michigan universities and one community college after conducting an independent review of various proposals for the development of a competency based curriculum for accredited degree programs. Continuing education for employees in the science and technology fields will also be a component of the curriculum.

Phase One award recipients include Kettering University, Wayne State University, Lawrence Technological University, and Lansing Community College. Phase Two, to be conducted in 2004 will be dedicated to the market entry of an alternative energy curriculum and the initial implementation. Full implementation and delivery will be the goal of Phase Three in 2005.

"The creation of a curriculum for technicians and engineers is a significant part of the infrastructure that will position the State of Michigan to take the leadership role in producing a workforce to continue alternative energy research and development", said Arwood. "The awards are expected to result in a seamless, statewide curriculum in alternative energy between two year and four year schools. It is imperative that students be able to transfer freely from one school to another without the

loss of credits."

Carolyn Upshaw-Royal, Director of Education and Programs for NextEnergy, has also begun developing a pilot for K-12 curriculum. And, Arwood said the company will work to establish scholarship and industry placement programs for students interested in advancing their education and experience.

NextEnergy also plans to host an annual international conference and other industry workshops and seminars. Arwood says that getting business and industry leaders together will play a key role in positioning Michigan at the forefront of the emerging alternative energy industry and allowing NextEnergy to serve as a catalyst for energy solutions.

"The conferences have three primary goals. The first is to begin educating on the issues that lay ahead for the state of Michigan and for the industry as a whole. Secondly, they serve as a networking function to bring the various elements of the industry together. And lastly, they will help industry players begin to understand the code and standards gaps that exist and that need to be closed to make this vision a reality," he explained.

NextEnergy hosted the first in a series of industry conferences on June 27 at the Westin Detroit Metropolitan Airport, to discuss ways of bridging the gap between today's technologies and tomorrow's advancements through collaborative working relationships. The conference titled: "NextEnergy: Striking Connections for the Alternative Energy Industry," drew

a crowd of about 300 that heard from industry leaders on a variety of topics including: The Future Supply Chain, Education and Outreach, Military Applications of Alternative Energy, and Infrastructure and Standards and Development. Another highlight of the conference was a presentation on tax incentives available to alternative energy companies in the state of Michigan.

NextEnergy and the National Hydrogen Association will be hosting a Hydrogen Safety Codes and Standards Workshop in September. The NHA Workshop will focus on reviewing the current status of hydrogen codes and standards and answering codes officials' question about hydrogen properties for demonstration projects.

As the future unfolds, Arwood says NextEnergy will continue to aggressively market and promote Michigan as a place for the retention, expansion and location of alternative energy industries. And, although the goals of NextEnergy may seem lofty to some, Arwood is confident that it will be successful in making Michigan home to the alternative energy industry.

"Michigan has been an industrial powerhouse for the last century, driven by fossil fuel energies. Our economic, human and intellectual resources are ideally positioned to take advantage of the new emerging energy markets. I am confident that we can lead a transformation in how vehicles are built and power is supplied," he said.

NEWSMAKER INTERVIEW: ROY WILLIS

For years, fuel cells have been talked about as the "wave of the future," and with the potential for higher efficiency, lower operating costs, zero emissions and quieter operations, there is no doubt that an exciting future lays ahead for the fuel cell industry.

Fuel cells will undeniably be an increasingly important component of the world's energy future and will have a key role in providing efficient, environmentally friendly electricity while extending our fossil fuel supply. The use of fuel cell technology is expected to revolutionize the power industry and tremendous advancements in performance and costs over the last decade are bringing the futuristic idea of fuel cells much closer to reality.

Enticed by the truly fantastic economic and environmental potential of fuel cells, a number of companies and organizations are actively involved in fuel cell research and development. And, according to the Propane Education & Research Council (PERC), propane will play an important role in the fuel cell revolution.

DG Insight recently had the opportunity to speak with PERC President Roy Willis to learn more.

DGI: What is PERC and what is its mission?

RW: The Propane Education & Research Council was authorized by an act of Congress that was passed and signed into law in 1996. It created the first energy commodity check-off program that is similar to some of the agricultural commodity programs for beef, pork, milk, etc.; however, we have a slightly different mission. Our focus is on the safe, efficient use of propane. To accomplish that mission we have literally undertaken four mission areas: research and development, consumer education, safety and training, and the statute also requires us to maintain a separate agricultural program mission area.

DGI: Why is PERC interested in fuel cells?

RW: PERC is investing in fuel cell technology as part of our overall strategy in technology development. Distributed generation is perceived as a real market growth opportunity, particularly given the fact that the propane industry, located in rural parts of the country, is well suited for limited distributed generation uses that

many folks say are likely to be some of the early adaptors of fuel cells -- that is in those areas that are remotely located and that require cost-effective fuel sources. We believe that ties in very naturally with the technology and infrastructure that propane already has in place.

In addition to offering one of the largest new market opportunities for us, we also were interested in launching our projects in fuel cell technology in part because we felt that propane was being overlooked. When we came into being in the late 90's, we were surprised to learn, at government and private sector forums on fuel cells, that very few of the larger leading research organizations were even investigating propane as a possible fuel source. To some extent our early research projects were as much to get us involved in that overall fuel cell research portfolio as it was with any immediate expectations for any near-term commercialization of the product. We have always looked at fuel cells as a mid-term to long-term research endeavor.

DGI: Why is propane a good fuel for fuel cell applications, particularly distributed generation?

RW: First of all, our nation doesn't have a distribution network for hydrogen, which is what most fuel cells require. Nonetheless, propane is a very high hydrogen content fuel that is fairly easy to reform into hydrogen. Its other characteristics also make it an ideal energy source for fuel cells. It has a well-established and reliable distribution infrastructure, which makes it readily available throughout the United States and indeed throughout the world.

Unlike some of the other fuels that are being considered by early fuel cell developers -- everything from gasoline to methanol and other fuels -- propane is one of the few that is non-toxic and is not water soluble, so even in the unlikely event of a leak in a storage system, you are not putting the ground and water supplies in significant environmental jeopardy. I might add that propane has already been used for other types of distributed generation, including everything from microturbines to internal combustion engine gensets and standby electricity supply systems. PERC is also co-funding the development of long-life, home-sized generating systems that are engine driven, such as the Marathon Engine. Fuel cells will have to

compete with these generating systems in terms of cost and reliability to penetrate the market.

DGI: What specific activities is PERC undertaking regarding fuel cells?

RW: Well, there are a lot. First of all, approximately 21 percent of our research and development budget last year was spent on fuel cell projects. Our total investment in fuel cells is about \$2.9 million, which in the larger scheme of things and the investment that the industry makes is not a large amount. But as I said, it is 21 percent of our budget, which is still fairly significant. With that investment we have undertaken 10 projects, three of which remain active currently, others have been completed and a few were not brought to closure for various reasons.

We are looking at projects that involve both proton exchange membrane (or PEM) fuel cells and solid-oxide fuel cells. Our focus is primarily on the reforming technology -- making sure you can reform propane and make hydrogen as efficient and cost-effective as other fuels. We think that is the key and that is one of the reasons that we have been involved with such a modest investment because our focus is not on what I refer to as some of the "downstream technologies," but in fact on ensuring that propane's role in fuel cell technology is as close to commercialization as we can get, so that when the rest of the technology crosses that commercialization threshold, we will be ready to go into the market with the general technology and not have to wait on our own components to be developed and perfected.

DGI: What results have been achieved so far?

RW: We completed a 1 kW working propane system that we developed with Nuvera. We are also working with Idatech and Global Thermoelectric. Our efforts right now are focused primarily on projects that are designed to provide sufficient power to handle remote telecommunications locations and residences or small commercial operations so we are focused on 1 to 5 kW range of fuel cell technology. It seemed to be a natural breakout as to what the industry was looking at and it seemed to fit what we believed the early market was going to be for this technology. I might also add that we have had two

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FARMS TURN TO POWER FROM MANURE

Manure doesn't have to just cause a big stink anymore. Instead of finding themselves stuck with tons and tons of animal waste to dispose of, production facilities with large animal populations are using manure to power their operations, and in some cases they are even selling power back into the grid.

Nolan Clark is the laboratory director and research leader for the USDA Agriculture Research Service at the Conservation and Production Research Laboratory in Bushland, Texas. He knows the ins and outs of turning manure into energy.

Clark explained that the term biomass can imply any kind of organic material that can either be burned or converted into some type of gas. "Normally when we think of that, we think of products that are waste products. They could be household waste products, they could be waste products from animal manure, they could be waste products from crop production. Biomass is a big encompassing word. When you go to a term like biogas, that means that you produce some kind of gas from a chemical process -- the decomposition of that biomass."

Manure is a high protein source, Clark said. "The animal does not use nearly all the protein that's there. When you have a decomposition of protein it will produce gases of ammonia, methane. You can combine those and use those by heating that and do what we call gasification, you can create a gas from that that you can use for consumption."

Using animal waste for energy is not a new phenomenon, Clark said. "In the great plains region of the United States, the settlers when they were moving west, picked up buffalo chips and used those for cooking fuel, so this is not a new experience for us to use this for fuel"

There are a couple of different ways to use manure from energy, either using a digester to convert the manure to gas or burning the manure straight, Clark said. "There's two different approaches. A lot of that depends upon the moisture content of the material you have available to you. You have to have the moisture content above 90/95 percent to be able to do a digester, so it's mostly a liquid that you're heating and treating to get the gas off of it. If it's below around 50 percent moisture, often times it's better to dry that out a little bit and pulverize and use it as a direct

burning application. It depends on what your material is like when you start with it, which direction you normally go."

Manure is typically processed through an anaerobic digester. Anaerobic digestion is the bacterial decomposition of organic matter that occurs in the absence of oxygen. Anaerobic bacteria exists naturally in moist and airless places, like the bottom of ponds and swamps and in the digestive tracts of some large animals. The anaerobic process is duplicated in a mechanical digester that creates the moist and airless conditions for decomposition. Mechanical digesters have been used primarily for nutrient recycling, waste treatment and odor control. Methane gas is the byproduct of the anaerobic digestion.

Clark said that the waste coming from dairies and swine production will have a high moisture content because of washing systems that are used in those facilities, so those operations use more digesters. He went on to say that, conversely, beef operations in an open feed-yard, have a lower moisture content in the manure "It's pretty dry and so you look at a direct burning application. It's the same way with poultry litter. It's usually fairly dry, 50 percent or 60 percent moisture content, so normally it will go with some type of dry application. Again, it comes back to what do you have as your beginning product? What kind of conditions that beginning product is in, which way it would go."

The critical question in the implementation of biomass manure is if there is large enough volume of the material so that it is not necessary to spend a lot of money to get it to the source where it can be converted into electrical energy that can be used close by. "You have to have a fairly good-sized dairy or pretty good-sized swine facility together to really make this economical," he said.

Clark said that there are several operations around the country that are turning manure into energy. "Most of those that I'm aware of do use some type of digester and they're either on a dairy or swine facility," he said.

The technology to use manure as biomass is well-known, but its growth depends on having the economics to make it work. "Some of it will come from government incentives. The renewable portfolios that many states have instituted are helping with this. Utilities over the next 20 years are going to be looking to expand

their generation capacity and their fuel supply sources. There's not too many options out there except to go to some type of renewable source. We're pretty well limited on coal and natural gas at this point and we haven't installed any new nuclear in 20 years, so I don't anticipate that coming back in the near term."

A number of companies are jumping ahead of the curve and implementing manure-based biomass systems today. In March, Portland General Electric (PGE) began operating a manure biogas project on the Cal-Gon dairy farm in Salem, Oregon. The facility converts more than 20 tons of manure into energy each day, feeding up to 70 kilowatts of electricity to PGE customers. Leftover materials are processed to be used for commercial nursery or farm soil applications.

PGE said that it hopes this system will eventually be cost-competitive with other renewable resources like wind and solar power and adds that biogas facilities give producers more flexibility in manure disposal. By lowering odor and their need for commercial fertilizer, herd sizes could be increased.

PGE is also planning a large farm project on Threemile Canyon Farms in eastern Oregon. Threemile Canyon Farms operates three dairies with more than 20,000 head of cattle. PGE says that the methane produced from these operations is expected to generate approximately four megawatts of green power.

PGE isn't the only company getting its hands dirty with manure. In June of 2001, We Energies and Ag Environmental opened the first fully operational manure-powered energy plant. The plant, located at Tinedale Farm in Wrightstown, WI can generate 750 kilowatts of electricity from methane gas produced by the decomposition of cow manure. Ag Environmental, a joint venture between Tinedale Farm and other environmental partners, owns the manure digester facility used to accelerate the decomposition process and generate electricity. The processed manure is returned to the farm and We Energies purchases the power for distribution throughout its service area. Tinedale Farm received funding from the Wisconsin Department of Commerce, the Brown county Revolving Loan Fund and Wisconsin Focus on Energy for the project.

The U.S. government has also taken up

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GRIDGATEWAY HOLDS INTERCONNECTION PROMISE

Distributed energy resources (DER) offer many potential benefits for the electricity system of the 21st century. Among them is the opportunity for greater local control of electricity delivery and consumption. In addition to supporting and strengthening the central-station model of electricity generation, transmission and distribution, DER can be used to meet baseload power, peaking power, backup power, remote power, and power quality needs. But before these benefits can be realized, a number of difficult technical, regulatory, interconnection, business, and environmental issues must be resolved.

Although viable DER technologies are currently available, deployment has lagged behind most expectations. That's because installation and integration into the power grid is not always easy, inexpensive, straightforward, or even predictable.

Customer-owned distributed generation has existed in the U.S. since the early days of the power system. However, the integration of these systems into the T&D systems of local utilities has traditionally been engineered on a case-by-case basis, taking into account the unique aspects of each site. Charged with ensuring that the connection of distributed resources to their electric systems are safe and will not negatively impact other power customers, local utilities often continue to evaluate and verify DER interconnections on a case-by-case basis -- a process that can be both pricey and lengthy. Today, however, the emergence of promising new distributed energy resource technologies has improved the prospect that DER could soon become widespread and eventually even commonplace.

Slated to play an increasingly important role in the nation's energy portfolio, DER technologies hold great promise for consumers and electric grid operators alike. Distributed energy resources can be very valuable to traditional energy customers looking for greater power quality and reliability, as well as to the power providers, who will save on building and infrastructure costs. Ideally, users who decide to produce enough power for their own needs could sell excess electricity back to the grid. However for this to happen, safe and reliable two-way power flow is essential.

To address this issue, the Electric Power Research Institute, (EPRI) is devel-

oping a low cost, intelligent, interconnection device intended to promote adaptable utility-grade protection for onsite generation and storage through its Distributed Energy Resources (DER) Program. Dubbed the GridGateway, the device will provide protection for onsite generation systems operating in parallel with the grid, programmable protective relay functions with communication links for monitoring and setup, and a testable interface that only the utility can access.

EPRI, headquartered in Palo Alto, Calif., was established in 1973 as a non-profit center for public interest energy and environmental research. EPRI's collaborative science and technology development program now spans nearly every area of power generation, delivery and use. EPRI's DER Program aims to help participants achieve competitive advantage through DER by way of direct application of new technology, new business ventures or investments, or through support for customer or third-party DER activities. Activities address DER technology development, performance validation, and field demonstration, as well as DER application strategies, integration with the power grid, and emerging policy issues.

"The electricity distribution system was never designed for two-way power flow," said EPRI project manager, Bill Steele. "Over the years, connections to the transmission and distribution networks of local electric utilities have been engineered according to the unique aspects of each site with the utilities ensuring that they are safe and will not adversely impact other power customers. This can be costly and time-consuming. EPRI's GridGateway provides a convenient solution."

Steele also says that sometimes end users don't understand the issues associated with evaluating and verifying DER interconnections and perceive that utility requirements are a barrier to interconnecting DER. Manufacturers of on-site generation and storage devices also face "non-standard" service connection requirements that they may consider to be a barrier.

"The GridGateway will help to remove the perception of barriers, and in some ways will be a technical solution to what may be viewed as a political problem," Steele said.

GridGateway builds upon a technology platform originally introduced by Pepco Technologies under the name GenerLink

and recently acquired by EPRI. Classified as a universal interconnection device, GridGateway is "plug-and-play" compatible with a standard 200-amp single-phase meter-based service and can be used by any distributed resource. It can also be programmed for any specific distribution feeder characteristics or limits.

"There is a growing need for low cost universal interconnection hardware that is 'plug-n-play' compatible with any DER prime mover equipment. The GridGateway will fill this need by functioning as a 'System Protection Engineer in a box', enabling safe and reliable two-way power flow," stated Steele.

The system protection features incorporated in the device will allow uploading of unique system protection functions, manage islanding conditions, and enable off grid operation while still allowing the DER equipment to serve the local load.

"A unique advantage of this approach is that it allows the electric distribution company to maintain control of the interconnection and periodically test its integrity," Steele explained.

In addition, the advanced technology in the GridGateway provides a "protective firewall" for the electric utility system. The GridGateway ensures that even if the DER manufacturer or the customer change the system settings, the utility will still be protected by the settings that were originally downloaded into the device. In addition, the GridGateway will give the utility the flexibility to change the interconnection settings when special conditions warrant doing so.

On-site generation systems include environmentally friendly technologies such as fuel cells, microturbines, and photovoltaics (PV). One of the near-term applications for the GridGateway technology will be to facilitate PV interconnections for commercial and residential establishments at significantly lower costs.

"This will be particularly timely, given that many states are requiring renewable resources as part of their future power generation mix," Bill Steele said.

According to Dan Rastler, technical leader of the EPRI DER Program, "GridGateway will fulfill a huge need for a low-cost, universal interconnection solution that's plug and play compatible with low power level DER generation equipment in the range of one kilowatt to 200 kilowatts.

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demonstration projects. One that is completed put a fuel cell at the west entry gate at Yellowstone National Park that we dedicated last September.

In addition to that, we are working on another distributed generation demonstration project with Kenai Fjords National Park in Alaska. Again, it is one of those cases where we already have propane onsite. There is an infrastructure to supply and deliver the propane, so having a propane-fueled fuel cell at that location is actually going to help improve the park's environmental protection efforts. Currently, they are using diesel fuel and a variation of heating oil to generate electricity, so they are looking for environmental benefits as an alternative to those generators that they have been using.

DGI: What else needs to be done to bring propane-powered fuel cells to market?

RW: Well, there are a couple of things that we are working on. We're going to continue to work on the reforming technology to make sure that it is maximized for efficient delivery of hydrogen with propane as a fuel source. We are going to continue to work on that until we feel we can't take the technology any further, and then we will probably do one or two other demonstrations just to make sure that we were right about our assessment.

In addition to that, we need to look at the needs of the technology. Propane is odorized with a sulfur-based compound. Odorant is necessary to detect leaks but sulfur is a contaminant, particularly in the

PEM fuel stacks. So making sure that we can effectively, consistently, and reliably remove that sulfur at the point of consumption is one of those areas that we are going to continue to perfect. Once again, we have demonstrated technology already that can do that job but we want to make certain that we have the most effective and cost-efficient technology that we can get.

So those are the two areas that from our perspective we will continue to work on. Unfortunately, I think that like most other fuel sources we are watching for the cost of the other components and some of the precious metals that go into fuel cells to come down in cost through the economies of scale. We want to be ready to move when that happens. I'm confident that it will happen. It's just a matter of time.

POWER FROM MANURE, CONTINUED FROM PAGE 5

promotion of biomass manure with the AgSTAR program, a joint effort by the Environmental Protection Agency, the Department of Energy, and the Department of Agriculture designed to encourage the use of methane recovery (biogas) technologies at confined animal feeding operations.

One of the greatest success stories of a biogas manure project is Haubenschild Farms, a family owned and operated dairy farm in Minnesota, selected as an AgSTAR "Charter Farm." Thirteen Charter Farms were selected nationwide to demonstrate farm-scale anaerobic digestion technologies. Haubenschild Farms also received assistance from the Minnesota Department

of Agriculture, Department of Commerce and Office of Environmental Assistance. The total cost of the construction of the digester and generator system was approximately \$355,000.

The digester began operating in October of 1999 and is a 350,000-gallon concrete tank installed in the ground, with suspended heating pipes to heat the manure inside the digester where bacteria breaks down the manure, creating methane. Before the digester was built, Haubenschild Farms entered into a power purchase contract proposed by East Central Energy, the local electric cooperative.

They started processing manure from

about 425 cows, and in 2000 expanded their operation to 750 cows. Since the expansion, the digester has been producing enough electricity to provide all the electric needs on the farm and enough surplus to power about 75 additional homes.

The Minnesota Project, a nonprofit organization dedicated to environmental protection and sustainable development, said that the building and operation of the Haubenschild Farms project offered several key lessons for future digesters, including the fact that a five-year payback on investment is possible. In addition, a good time to install a digester is when changing or expanding operations, and electric utility cooperation is important.

GRIDGATEWAY, CONTINUED FROM PAGE 6

It is also very cost effective; installed costs are estimated to be under \$400 for mass markets."

"Successful development of the GridGateway will essentially eliminate costly interconnection transactions for low power DER systems," Rastler noted. "DER hardware suppliers will stand to benefit, too. They will be able to focus on product development without the added burden of supplying their own proprietary interconnection devices."

EPRI is now seeking funding to complete the development of the GridGateway. "We are currently raising funds to develop a few Beta prototypes. Once

funds are raised, it should take about 18 months to develop and test them. The final development and commercialization would directly follow," said Steeley.

Early participants in EPRI's GridGateway project will play a leading role in specifying requirements and testing the functionality of the early devices. The cost for each participating utility is \$70,000 and a minimum of seven sponsors will be required to embark on the development. Project sponsors will be given priority to participate as a shareholder or via a license agreement in subsequent business plans and project commercialization.

EPRI believes faster implementation of

DER on the utility grid will allow the systems to operate in a manner that protects the environment as it maximizes value to end-users and electric grid operators.

"Participants in this project will play an instrumental role in eliminating today's concerns over the safety and control of the DER interconnection in a way that will enable the utility to retain control of the interconnection function," said Steeley. "This will ensure faster implementation of distributed resources on the utility grid and allow DER to operate in an optimized manner to maximize value to both users and energy suppliers while protecting the environment."

AVISTA LABS GOES PRIVATE

While most private fuel cell developers likely wish that they had deep-pocketed utility parents, one such company is taking the opposite tack. Just this month, Avista Labs, a subsidiary of utility Avista Corp. announced that it was going private.

A group of venture capitalists, led by Vancouver-based Chrysalix Energy LP and including Wall Street Technology Partners of New York, and Buerk Craig Victor LLC of Seattle has agreed to provide \$7.5 million to a new private owner of Avista Labs, AVLB Inc. The new funding will be used to support Avista Labs' continuing development and commercialization of its fuel cell products. Former parent Avista Corp. will own 19.9% of the new company and has also committed to provide additional future funding of up to \$1.5 million under certain conditions.

Avista Labs, founded in 1995, is a developer of modular, cartridge-based, proton exchange membrane fuel cell technology. Avista's fuel cells are unique in that they use hot swappable Modular Cartridge Technology™. Cartridges offer greater reliability in the event of a membrane failure, easier servicing, fewer moving parts, and greater scalability than common stack designs. The individual modules are housed in subracks which can be grouped together to meet almost any sized load with precision.

Avista Labs' primary product is the Independence 1000 fuel cell. Introduced in 2001, the Independence 1000 is powered by eight of Avista Labs' hot swappable 650 series modular power cartridges. It is designed to provide power in a variety of backup power situations and produces 1 kW of DC power. All told, Avista Labs currently has fuel cells installed at more than 80 sites worldwide.

"We have been very fortunate to have the kind of support from Avista Corp that we have enjoyed over the past several years. Their financial support and assistance has allowed us to grow to the point where we are selling products to real-world customers, and we are pleased to continue the relationship through their minority ownership," said Avista Labs President and CEO, Mike Davis. "Going forward, this group of investors is poised to accelerate our commercialization efforts. They provide access to a strong pool of resources and expertise that will attract partners and customers to the company's

unique offering. Together, we can continue to build on Avista Labs' leadership position in the premium power markets and beyond."

It's no surprise that Avista Corp. is selling most of the unit, which has been losing money for years. In the first quarter of 2003, Avista Labs had revenue of \$150,000, and a loss from operations of \$2 million. In the same period a year ago, Avista Labs also recorded \$150,000 in revenue, but the loss from operations was higher at \$2.7 million. Avista in the second quarter will record an impairment charge of about \$2.5 million, or 5 cents per share, related to the reduction in ownership interest. It also said it will account for the unit's second-quarter losses, along with the impairment charges, as a discontinued operation.

Avista has long tried to get rid of its fuel cell unit, although the reasoning behind a divestiture has changed significantly. In January 2000, Bill Gates bought 5% of Avista Corp., and many observers felt his investment was a vote of confidence in Avista Labs. In May 2000, still riding the positive press created by Gates' high-profile investment, Avista Corp. hired Merrill Lynch as its investment bank and strategic adviser for Avista Labs to assist in evaluating the best ways to maximize the shareholder value inherent in Avista Labs' fuel cell technology.

Merrill Lynch was instructed to consider all possible options, including financial restructuring and an initial public offering. "Avista Labs continues to mark significant milestones as it demonstrates its leadership in commercializing and advancing fuel cell technology. The next logical step is to work with Merrill Lynch to help identify the best way to unlock the value that Avista Labs holds so we can maximize shareholder value," said Tom Matthews, Avista Corp.'s chairman, president and chief executive officer at the time.

After reviewing the possible options, Merrill Lynch came back with a recommendation for an Initial Public Offering (IPO). Avista Corp. liked the idea and began to move forward with a plan to do an IPO in 2001. But the market had already turned downward, so in March 2001, the company called off the IPO. Avista Corp. said that instead Merrill Lynch would continue to look at strategic options for Avista Labs.

Initially, Avista's objective in looking at financial options for Avista Labs was to

unlock the perceived value of the unit for the parent company while it waited for commercialization to occur. But as the market soured on energy companies, its motive changed from profit to survival. Since peaking in early 2000 at a price of over \$50 per share, Avista Corp.'s stock fell below \$9 before recovering to its current \$14.

Given the continued downturn for energy stocks in the market, Avista began looking for strategic partners to invest in Avista Labs. In the meantime, Avista Labs focused on meeting its financial targets and controlling costs in order to look more attractive to suitors. In an effort to cut costs, Avista laid off six managers in May 2002, including company president Kim Zentz, and 21 more employees in August 2002, leaving it with 45 employees.

"Balancing cash needs with our ongoing focus on meeting development milestones is essential for the success of Avista Labs," Gary G. Ely, chairman, president and chief executive officer of Avista Corp. said. "Labs had been organized to operate as a stand-alone company. But it does not look like the capital markets will be favorable for that type of operation in this sector any time soon."

Now it looks like Avista has found its savior in the private equity market with venture capitalists who believe the company has a bright future. "We believe Avista Labs has the potential to be a dominant player in this multi-billion dollar industry," said Wal van Lierop, President and CEO of Chrysalix. "Avista Labs stands out as a company with real commercial product developed to meet the specific needs of customers in the premium backup power market."

"Two years ago Avista Labs purposely shifted their market focus to the premium power markets with fuel cells running on bottled hydrogen for backup power applications," stated Adam Lichtenstein, partner, Wall Street Technology Partners. "The fact that many other PEM fuel cell developers are now focusing on this same market validates the move by Avista Labs and strengthens their leadership position in this space. Since the addressable markets are quite sizable to support numerous suppliers, this is very positive for the industry as a whole."

Only time will tell if the bet that these venture capitalists are making on Avista Labs is a wise one.

COMPETITION COMES BACK TO MICROTURBINES

Finally, competition is returning to the microturbine business. Since Honeywell quit the business in September 2001, Capstone has pretty much had the market to itself. However, a new competitor which has been quietly working on its microturbine technology for a decade is starting to make a major move with its commercial units.

Ingersoll-Rand (IR) Energy Systems has steadily been making progress getting its PowerWorks microturbine system to market and appears ready to challenge Capstone for market leadership.

"Our first commercial production units represent a significant maturation of the product," explained Jim Watts, director of marketing for IR Energy Systems. "They are an important latest step in the development of a product that started with the first demonstration prototypes in the early 1990s. The progression continued with the development of our breakthrough recuperator technology around 1994 and the start of our commercialization efforts in 1996 with the support of Southern California Gas, the New York Gas Group and the Gas Technology Institute (formerly GRI). These efforts have continued with our deployment of alpha and then beta field test units starting in 2000."

The key to the PowerWorks microturbine is its patented recuperator technology, which is critical to the unit's high efficiency and 80,000 hour design life. The recuperator significantly raises the electrical efficiency of the microturbine and allows the system to operate at relatively moderate temperatures. By avoiding more extreme conditions, the overall life of the microturbine is greatly lengthened and reliability is enhanced.

The company is selling systems with both 70 kW and 250 kW microturbines. Recently adapted for end-user applications, IR's microturbine technology functions as an on-site, generation plant that can complement or supplement the user's other sources of power. These systems use natural gas or other fossil fuels to produce small-scale electricity in the ranges of 70 kilowatts for a single unit, to three megawatts of capacity with multiple units. Exhaust heat from the microturbine can also be used to produce hot water or steam in a highly efficient combined heat and power (CHP) plant. The 70 kW unit, which was the first to hit the market, received a UL2200 listing in March from Underwrit-

ers Laboratories. UL2200 is a safety standard that establishes construction and mechanical systems performance requirements for stationary engine generator assemblies. It asserts that listed equipment can be safely installed and used in accordance to national requirements. "According to UL, this is the most comprehensive listing of any package or sub-assembly by Ingersoll-Rand," said Jason Hargrove, who served as certification team leader.

One of IR's key demonstration projects for its 75 kW unit is the Jamacha Landfill Gas Utilization Project in San Diego County, California. Jamacha uses four 75 kW microturbines to generate electricity by firing landfill gas collected at the site. The units not only generate electricity for the plant, but also hot water needed by commercial customers and nearby residential areas.

The Jamacha Landfill has an estimated rate of return of seven years on the project. IR says this is longer than normal because only 10 percent of the electricity is used onsite. The rest is sold to the local utility, San Diego Gas and Electric (SDG&E).

The plant first exported power to SDG&E on June 15, 2001 and has successfully operated on landfill gas varying in methane content from 35 percent to 45 percent. The plant also utilizes an advanced supervisory control and data acquisition (SCADA) system, which allows the power plant's compressor and individual microturbines to be monitored and operated either at the site, through a touch screen interface unit, or from any remote location by laptop computer.

While the Jamacha project has helped IR demonstrate its technology to potential customers, finding those customers is still an issue. Therefore, in order to strengthen its distribution of microturbines, IR has formed a strategic alliance with Siemens Building Technologies. The alliance enables Siemens to integrate PowerWorks microturbine-based on-site generation solutions of Ingersoll-Rand's Energy Systems business into its Strategic Energy Program offerings to customers. In turn, IR will be able to offer its customers the energy-management expertise and services of Siemens. These energy services include supply-side management, procurement, utility information management, and demand-side optimization.

Siemens will integrate into its energy

management services and solutions portfolio the IR 70-kilowatt and 250-kilowatt PowerWorks microturbine products to create a new offering -- Microturbine Energy Systems. The combined offerings of the two companies are designed to better meet the energy user's increasing business challenges of controlling energy prices while assuring the quality and reliability of electricity supply.

"We are excited about a partnership with Siemens which creates an energy-management solution that incorporates the proven technology of PowerWorks microturbines," said Randy Adleman, president, Ingersoll-Rand Energy Systems. "Through the combined strength of our two companies, more customers will have access to a highly efficient and flexible approach in meeting their on-site generation needs."

Microturbine Energy Systems will be available to customers as a standard Siemens offering and delivered by its 150-branch organization through North America. Each Siemens' branch office will then offer its local customers a customized solution that draws on Siemens extensive resources of technical and applications expertise, supply-side and demand-side strategies, and technical support services.

So IR seems to be establishing a foothold in the microturbine market, but its success is threatened by the rising price of gas. To counter this, IR is focusing on customers that have "free" gas -- landfills. On April 24, IR introduced its EcoWorks brand of microturbine systems at the 26th Annual Landfill Gas Symposium in Tampa, FL. They are compact, integrated and matched systems which include one or more microturbines, a fuel conditioner and switchgear. With a built-in cogeneration system, heat and hot water can be exported to on-site customers. Specifically designed for landfill gas, the EcoWorks microturbine system can operate on low-flow, low-pressure and low-BTU gases.

This strategy seems to be working as sales are picking up. IR recently reported that its Energy Systems division received customer orders for more than \$8 million of microturbines during the second quarter of 2003, compared to approximately \$1 million for the same period last year. By comparison, Capstone reported revenue for the second quarter 2003 of \$4.1 million as compared with \$7.4 million for the same period last year.

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SELFGEN PROGRAM FINDS SUCCESS

California has been one of the most aggressive states in promoting distributed generation and a keystone of its efforts is the SELFGEN Program.

SELFGEN got its start on September 6, 2000 when California Governor Gray Davis signed AB 970 which directed the California Public Utilities Commission (CPUC) to develop load control and distributed generation programs. Pursuant to AB 970, the CPUC's Energy Division developed and the CPUC subsequently approved the Self Generation Incentive Program (SELFGEN) on March 27, 2001. This program provides cash rebates to eligible customers that produce part of their own energy through "self-generation."

The SELFGEN Program is designed to complement the California Energy Commission's (CEC) existing Emerging Renewables Buydown Program. This is accomplished primarily by focusing on the commercial/industrial/agricultural market sectors and through the inclusion of select renewable and nonrenewable-fueled self-generation technology - up to 1,500 kW in generating capacity. Coordination with the CEC Buydown Program occurs through participation in the Statewide Self-Generation Incentive Program Working Group and through a separately managed statewide self-generation program compliance database.

The SELFGEN Program has three incentive categories -- Levels 1, 2, and 3. Level 1 applies to PV, wind, and renewable-fueled fuel cells with a minimum size of 30 kW. These projects get a rebate of \$4.50 per watt up to 50% of the project cost. Level 2 applies to non-renewable-fueled fuel cells of no minimum size. These projects get a rebate of \$2.50 per watt up to 40% of the project cost. Level 3R applies to renewable-fueled microturbines, ICs, and gas turbines of no minimum size. These projects get a rebate of \$1.50 per watt up to 40% of the project cost. Level 3N applies to non-renewable-fueled microturbines, ICs, and gas turbines of no minimum size. These projects get a rebate of \$1.00 per watt up to 30% of the project cost.

Initially, the total Program annual incentive budget is equally allocated among Program Incentive Levels 1, 2, and 3. SELFGEN Program administrators have the discretion to shift funds from Levels 2 & 3 into Level 1. Shifting funds from Level 1 to Levels 2 & 3 requires prior approval from the CPUC.

Statewide, the SELFGEN Program receives \$100 million per year to be used for rebates and administrative costs of the program. The CPUC recently ruled that unused funds from a prior program year can be "carried forward" and used for reservations and incentives in the current program year. Also, in the event funds are fully reserved for the current year, CPUC will allow administrators to "borrow forward" from future program year incentive budgets. The SELFGEN Program will continue to accept applications through December 31, 2004, subject to availability of the regional Administrator program funds for their respective geographic areas and funded Incentives Levels.

Generally, any customer receiving electricity service from an investor owned utility and meeting the applicant and host customer eligibility requirements can apply for funds through the SELFGEN Program. Customers specifically not eligible for the Program include customers who have entered into contracts for Distributed Generation services and who are receiving payment for those services. In addition, any portion of customer load that is committed to electric utility interruptible, curtailable rate schedules, programs or any other state agency-sponsored interruptible, curtailable, or demand response program is not eligible.

In February 2002, the CPUC made some adjustments to the program. The maximum project size and corporate parent limit for self-generation incentives was increased from 1,000 kW to 1,500 kW. The CPUC also clarified that customers of municipal electric companies who purchase gas from investor owned utilities were eligible for the program.

The SELFGEN Program received 261 requests for funding in program year 2001 and 402 requests for funding in program year 2002. Approximately 21% of the 2001 projects remained active (not withdrawn or rejected) as of January 2003, accounting for roughly 18% of the total potential installed capacity of 2001 projects, at 17,943 kW. Approximately 69% of the 2002 projects remained active as of January 2003, accounting for roughly 70% of the total reported potential installed capacity of 2002 projects, at 86,685 kW.

Approximately 8% of 2001 projects were completed and paid as of January 2003, which represented 5,776 kW of installed capacity and \$7.8 million in

incentives. The majority of completed 2001 projects represented Level 3N technologies, followed by Level 1 technologies. Only one Level 2 project was completed during 2001. For 2002, approximately 3% of projects were completed and paid as of January 2003, which represented 2,181 kW of installed capacity and \$5.0 million in incentives. Furthermore, almost all of the projects completed during 2002 represented Level 1 technologies.

Internal combustion engines using non-renewable fuels were the most popular technology adopted by host customers within the commercial, industrial, and agricultural sectors, while photovoltaics was the most popular technology adopted within the transportation, communications and utilities sector.

MICROTURBINES, CONTINUED FROM PAGE 9

IR also got some welcome publicity when the Greenhouse Gas Technology Center (GHG Center) announced on July 1 that it had independently verified the performance of IR's 70 kW microturbine system.

Verification of the system was conducted at the Crouse Community Center, a 60,000 sq. ft. nursing facility in Morrisville, New York, with support from the U.S. Environmental Protection Agency and the New York State Energy Research and Development Authority. The system was installed to provide electricity to the facility and provide heat for domestic hot water and space heating.

During performance testing 50.62 kW of electric power was generated at full load and "free" heat was recovered as hot water at a rate of 146 MBtu/hr. Total combined heat and power energy efficiency was 46 percent and the average NOX emissions were low, 0.86 parts per million.

Emissions from the system were compared to emissions that could have occurred if the Crouse Center obtained its electrical power and hot water from conventional sources -- grid electricity and an on-site gas-fired boiler. The GHG Center estimates that an average annual emission reduction of 1,333 lbs (34 percent) for NOX and 211,744 lbs (7 percent) for CO2 would occur with use of the PowerWorks.

IR appears to be on its way with its new microturbines and its success can only bode well for the industry as a whole.

DISTRIBUTED GENERATION IN THE NEWS

FERC Proposes Small Gen Interconnection Standards

FERC proposed a rule that would apply to the interconnection of small generators no larger than 20 megawatts. The proposed rule should expedite the interconnection of small generators, many of which use alternative fuels such as wind and solar, and innovative technologies. The rule should preserve reliability, increase energy supply, and increase the number and variety of new generation sources, including the use of non-polluting alternative energy sources, the Commission said. The Commission also believes that the proposed rule contains procedures and provisions that state regulators could use for generator interconnections under their authority. The proposed standards would apply to all public utilities that own, operate, or control transmission facilities in interstate commerce. The proposed rule includes small generator interconnection procedures that the public utility transmission provider and an interconnection customer must follow throughout the interconnection process. The proposed small generator interconnection agreement establishes the legal rights and obligations of each party, addresses cost responsibility, lays out milestones for completing the project, and sets forth a process for dispute resolution.

Japan to Conduct 31 Fuel Cell Tests

Japan will carry out tests for household-use fuel cell systems at 31 locations across the nation, including Osaka, Nagoya and Sapporo, over a one-year period from this autumn, a government agency said. The New Energy Foundation (NEF), an affiliate of the Ministry of Economy, Trade and Industry, will install fuel cell systems at households and small retail outlets, such as convenience stores. It will test two types of fuel cells -- one with a power generating capacity of one kilowatt and another with a capacity of 5 kilowatts. Four types of fuels -- city gas, liquefied petroleum gas, kerosene and naphtha -- will be used to examine which fuel generates power most effectively, the NEF said. Ishikawajima-Harima Heavy Industries Co., Kurita Water Industries Ltd. and three other firms will supply fuel cell systems for the experiment, in addition

to six companies that supplied such systems in the previous year's experiment carried out at 12 locations.

San Diego To Push For More DG

A new movement is quietly being led by a more establishment group that is equally determined to topple San Diego Gas & Electric from its long rein as regional energy monarch. Including such disparate members as Qualcomm, the Utility Consumers' Action Network, the city of San Diego and a small-business trade association, the group known as the Regional Energy Policy Advisory Council set a course for a regional energy future different from the one envisioned by SDG&E. It's a vision that would have San Diego County invest much more heavily than SDG&E recommends in pursuing clean renewable energy, local sources and small new electricity-generating units in homes and businesses. The council's members have signaled their commitment to break with an energy planning paradigm they say is dominated by a utility with interests that sometimes might not be the same as the public's. The group raised the possibility of pressing for a regional energy authority to oversee implementation of its vision. With heavy community input from a broad advisory panel, the council has concluded that San Diego County can move much more quickly to an energy system based on clean, renewable sources of power, many of which could be built in the county. The council is a group of 13 local government, business and community leaders commissioned to formulate an energy plan for the San Diego Association of Governments. The San Diego Regional Energy Office provides the council with administrative and technical support. To get an independent factual basis for its work, the council paid Science Applications International Corp. \$400,000 last year to perform a comprehensive study of the region's energy infrastructure. The study formed the basis for an energy plan and then led to a vote on how best to implement the plan. The advisory role proposal favored by SDG&E won support only from Encinitas Mayor Jerome Stocks. Instead, the council voted overwhelmingly to recommend that the association of governments establish a new energy committee with the council as its core and move to

create some sort of regional energy authority after 18 months, if needed, to implement its energy plan. The regional power authority also would have the power to float bonds and construct power projects.

DTE ET to Remotely Monitor Fuel Cells

DTE Energy Technologies will remotely monitor and control Plug Power fuel cell systems via the company's proprietary energy|now System Operations Center (SOC). Through an agreement between Plug Power and DTE Energy Technologies, the companies plan to make available to all future customers of Plug Power fuel cells the ability to use the energy|now System Operations Center to make remote monitoring an available feature on all systems. The energy|now SOC is a web-based, remote monitoring and control service that provides the opportunity for on-site energy users to add centralized, end-to-end management of all the vital functions required to serve electric loads and maintain the reliability of on-site energy systems. Information can be accessed over the Internet around the clock and can be archived for up to three years. The SOC also can be integrated with primary electric and gas meters and provides peak demand notification to enable customers to better manage their energy costs. The SOC currently monitors energy|now and many other brands of on-site power equipment.

Winery Turns to Power-Light Solar Energy

PowerLight Corporation has completed another on-site solar generation system at a California winery. This new photovoltaic (PV) system is located at Domaine Carneros' new Pinot Noir winery in Napa. The installation, which features a 120 kW solar electrical system, is the largest solar PV installation at a U.S. winery, according to the company. The new PowerLight solar generation system, installed atop the new Domaine Carneros Pinot Noir wine-making facility, covers 9,400 square feet of the new facility, which is situated directly behind Domaine Carneros' renowned chateau. Now that it's operational, the solar system supplies the Domaine Carneros facilities with up to 40 percent of the winery's electricity needs.

FINANCIAL HAPPENINGS

A new bidder has emerged to buy Calgary fuel cell technology maker **Global Thermoelectric Inc.**, offering the company a competing proposal that Global plans to negotiate once it signs confidentiality agreements. The new offer is a "superior proposal" to a \$108-million stock-swap takeover by Quantum Fuel Systems Technologies Worldwide of Irvine, Calif., which was first announced in April and was scheduled to close in the third quarter. "Global intends to commence negotiations with the party making the proposal once a confidentiality agreement is executed," the Calgary company said in a statement, adding that the competing proposal is still subject to full approval of Global's board. Global's board "is not making a recommendation as to how common shareholders should vote," the company said. Global said it will not comment further on the bidding process until either an agreement is entered into with the competing bidder or discussions are discontinued.

RWE AG, Germany's largest electric utility and one of the largest in Europe, will establish a joint venture with **MTU**, a DaimlerChrysler AG company and FuelCell Energy's European technology and distribution partner to market carbonate fuel cells to a broad European market. Under the terms of the agreement, RWE Fuel Cells GmbH will hold a 25.1 percent stake in the new company. The joint venture, MTU CFC Solutions GmbH, will seek to develop a leading market position for high temperature stationary fuel cells. Under the agreement, MTU said it will contribute its considerable lead in technology for stationary fuel cells, while RWE, as one of the leading European power companies, will provide the corresponding market access, thus ensuring the broad-based introduction of the fuel cell. MTU has been operating a 250 kilowatt combined heat and power fuel cell power plant at an energy park operated by RWE. The fuel cells were manufactured by FuelCell Energy and shipped to MTU for incorporation into their power plant known as the "Hot Module." Other MTU fuel cell power plants are operating in Germany at a Michelin tire plant in Karlsruhe, a Deutsche Telecom telecommunications center in Munich, a university medical clinic in Magdeburg, a hospital in Bad Neustadt/Saale, and a shipbuilding facility in Cartagena, Spain.

Capstone Turbine Corporation report-

ed its results for the quarter ended June 30, 2003. Revenue for the quarter was \$4.1 million as compared with \$7.4 million for the second quarter of 2002. Capstone shipped 108 units, comprised of 48 of its 60-kilowatt systems and 60 of its 30-kilowatt systems, in the second quarter of 2003. For the second quarter of 2003, Capstone's net loss was \$9.4 million, or (\$0.12) per share compared to a net loss of \$30.8 million or (\$0.40) per share during the second quarter of 2002. The loss during the second quarter of 2002 included \$16.0 million from the impairment of marketing rights and \$1.8 million related to excess inventory charges. Gross loss in the quarter was \$2.6 million, compared to \$4.2 million for the same period in the prior year. The 2002 period included charges of \$1.8 million related to excess inventory. Research and development ("R&D") costs increased to \$2.5 million in the period, as compared to \$1.6 million in the second quarter of 2002. R&D expenses are reported net of contract offsets. These offsets were \$0.1 million and \$1.3 million in 2003 and 2002, respectively. Selling, general and administrative expenses decreased to \$4.7 million, less than half the \$9.7 million recorded in the second quarter of 2002. As of June 30, 2003, Capstone had \$126.4 million in cash and cash equivalents, with no long-term debt. The company's cash utilization was \$6.2 million in the second quarter of 2003, compared to \$9.2 million in the second quarter of 2002 and \$7.7 million in the first quarter of 2003.

FuelCell Energy Inc., which in May cut about a quarter of its jobs, said it is now furloughing some employees because of the soft economy. About 7 percent of FuelCell's work force, primarily in Torrington, CT. would be affected by the furloughs. The move comes after FuelCell laid off 45 to 50 people in a variety of positions at each location, or about 90 people in all. Until recently, the Danbury-based company employed about 150 people making its power plants in Torrington and about 330 people overall. That means about 24 people would be furloughed, though the company would not specify how many employees were affected at either facility.

Solar Hydrogen Energy Corporation (SHEC Labs) announced that SHEC Labs has completed the second closing of a private placement offering whereby 18,406 Class A Common Shares were issued to

subscribers resident in the provinces of Saskatchewan and Alberta, resulting in gross proceeds of \$36,812.00. Under this offering, the company will continue to offer up to an additional 2,442,033 Class A Common Shares at a price of \$2.00 per share to subscribers resident in the provinces of British Columbia, Alberta, Saskatchewan and Ontario. The minimum investment for all subscribers is \$1,000. The proceeds of this offering will be used by SHEC Labs as working capital to continue to pursue its core research and development activities, as well as the commercialization of spin-off technologies.

AstroPower, Inc. announced that the company's common stock was delisted from the Nasdaq National Market as of Friday, July 25, 2003. This decision arises as a result of AstroPower's previously announced failure to timely file its Annual Report on Form 10-K for the December 31, 2002 fiscal year and its Quarterly Report on Form 10-Q for the first quarter of 2003 because of its ongoing review of revenue recognition matters. The Listing Qualifications Panel denied AstroPower any further extension of time to make these filings. AstroPower intends to appeal the Panel's decision, but this appeal will not stay the delisting and AstroPower cannot predict whether or not the Listing Council will modify or reverse the Panel's decision. Following delisting, AstroPower's common stock will not be eligible to trade on the OTC Bulletin Board until the company becomes current in all of its periodic reporting requirements and a market maker makes an application to register in and quote the company's common stock.

Teledyne Technologies reported second quarter 2003 sales of \$205.4 million, compared with sales of \$188.0 million for the same period in 2002. The Energy Systems segment's second quarter 2003 sales were \$3.5 million, compared with second quarter 2002 sales of \$3.3 million. The second quarter 2003 operating loss was \$0.2 million, compared with an operating loss of \$0.9 million in the second quarter of 2002. Second quarter 2003 sales reflected revenue growth in hydrogen generators and fuel cell test stations, partially offset by lower government sales. The second quarter 2003 reduction in operating loss, compared with the same period of 2002, resulted from an improved overhead cost structure and lack of program cost adjustments that impacted 2002.

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